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Subdiffusion of volcanic earthquakes

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Abstract

© 2017 Institute of Geophysics, Polish Academy of Sciences & Polish Academy of SciencesA comparative study is performed on volcanic seismicities at Icelandic volcano, Eyjafjallajökull, and Mt. Etna in Sicily from the viewpoint of complex systems science, and the discovery of remarkable similarities between them is reported. In these seismicities as point processes, the jump probability distributions of earthquakes (i.e., distributions of the distance between the hypocenters of two successive events) are found to obey the exponential law, whereas the waiting-time distributions (i.e., distributions of inter-occurrence time of two successive events) follow the power law. A careful analysis is made about the finite size effects on the waiting-time distributions, and the previously reported results for Mt. Etna (Abe and Suzuki 2015) are reinterpreted accordingly. It is shown that the growth of the seismic region in time is subdiffusive at both volcanoes. The aging phenomenon is commonly observed in the “event-time-averaged” mean-squared displacements of the hypocenters. A comment is also made on (non-)Markovianity of the processes.

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Keywords

(Non-)Markovianity, Exponential jump probability distributions, Finite-dada-size effects, Power-law waiting-time distributions, Subdiffusion, Volcanic seismicity